

Patent claims

- 5 1. A method for depositing a wipe-proof and rub-proof marking or code marking, in particular a two-dimensional point coding onto glass or glass receptacles such as glass ampoules, syringes, glass bottles, vials and likewise, by the following method steps:
- producing a preferably pulsed laser light beam of a wavelength < 380 nm
 - engraving the marking into the glass or into the glass surface by deflecting a laser light
 - 10 beam in a first and in a second direction,
- characterised in that**
- the glass receptacles O_n (10) are moved along a transport path and in a transport direction (21), subsequently arbitrarily defined as the x-direction,
 - at least the position of an object O_1 to be individually inscribed is detected or determined
 - 15 at least one position along the transport path,
 - along the transport path at a writing position W located at a distance to the laser, the laser beam (23) is triggered in dependence on the position of the glass receptacle (10), and a two-dimensional marking M_a stored in the control unit (47) is written into the surface of the object to be inscribed in that the laser beam (23) is scanned (rastered) over the surface in the x- and y-
 - 20 direction, and
 - the marking M_a (25) written into the surface of the object at least at one position R located after the writing position seen in the transport direction is read and compared to the two-dimensional marking M_a stored in the control unit (47), wherein with a non-agreement between the written and read marking M_a the object is rejected and separated out.
- 25
2. A method according to claim 1, characterised in that the laser beam (23) is deflected in the x- and y-direction with the help of an activatable 2D scanner mirror (35).
3. A method according to claim 1 or 2, characterised in that the focus depth of the laser
- 30 beam (23) in the region of the writing surface is set to > 0.2 mm, preferably > 0.5 mm and very particularly preferred > 1.00 mm.
4. A method according to one of the claims 1 to 3, characterised in that the laser beam is set to an energy density of > 2 J/cm², preferably > 5 J/cm² and very particularly preferred > 10
- 35 J/cm².
5. A method according to one of the claims 1 to 4, characterised in that an object O_2 following the object O_1 with the marking M_a is provided with a marking M_b , a subsequent object O_3 is provided with a marking M_c , etc.

6. A method according to one of the claims 1 to 5, characterised in that the glass receptacles (10) are transported continuously and preferably with the same transport speed and the laser beam (23) is tracked according to the transport speed of the objects (10).
- 5 7. A method according to one of the claims 1 to 6, characterised in that the impingement points of the light impulses in each case at least partly overlap.
8. A method according to one of the claims 1 to 7, characterised in that each data point or pixel is formed by a plurality of at least partly overlapping laser impulses.
- 10 9. A method according to one of the claims 1 to 8, characterised in that each data point or pixel is formed of two or more tracks or channels lying next to one another.
- 15 10. A method according to one of the claims 1 to 9, characterised in that the marking is engraved into the superficies of a glass receptacle (10) or on the neck or at a short distance to the filling opening of the glass receptacles (10).
11. A method according to one of the claims 1 to 10, characterised in that curved surfaces with radii between 3 mm to 50 mm, preferably 5 mm to 30 mm are provided with markings.
- 20 12. A method according to one of the claims 1 to 11, characterised in that a point coding of $n \times m$ preferably square points or pixels are written in a raster scan.
- 25 13. A method according to one of the claims 1 to 12, characterised in that a liquid or solid substance or a liquid or solid substance mixture is deposited onto the location of the glass to be inscribed before the writing procedure.
14. A method according to one of the claims 1 to 13, characterised in that for reading the marking (25) for producing an increased contrast ratio between the inscribed and unscribed glass surfaces light is introduced into the glass wall of the glass receptacle (10) at a distance to the marking (25) and the scattered light is detected with the help of a CCD camera (17).
- 30 15. A method according to one of the claims 1 to 14, characterised in that the marking (25) is deposited onto curved surfaces, in particular superficies of glass receptacles which are round in cross section.
- 35

16. A device (11) for depositing a wipe-proof and rub-proof marking (25) or code marking, in particular a two-dimensional point or line coding consisting of a plurality of data points or pixels onto glass receptacles such as glass ampoules, glass bottles, vials and likewise, with

- a transport means (13) having a drive, with one or more accommodating devices (20) for objects to be inscribed,

- a laser system (15) arranged at a distance to the transport means (13) with a laser source for producing a laser light beam (23) of a wavelength < 380 nm, said laser light beam (23) in operation being directed onto the transport path and defining an impingement point in the region of at least one accommodating means moved along the transport path,

- means in order to change or move the impingement point of the laser light beam with respect to at least one accommodating means of the transport means, e.g. by way of at least one deflection means (35), e.g. scanner mirror, in order to deflect the laser light beam (23) in a first and in a second direction continuously or in certain incremental intervals,

- at least one control unit (47) comprising a memory unit and a microprocessor which is in connection with the laser system (15) and the deflection means (35), for controlling at least the deflection system (35) and the laser system (15),

characterised in that

- the transport means (13) is designed for the transport of glass receptacles (10) to be marked, along a transport path,

- a means (17) for detecting or determining at least the position of at least one accommodating means (20) or a glass receptacle (10) accommodated therein is provided at at least one position R along the transport path, said means being in connection with the control unit (47) or the deflection means (35),

- in the memory unit there is stored a program which triggers the laser (15) in dependence on the position of the glass receptacle (19) to be inscribed, as well as at least one marking pattern M_n , according to which the deflection means (35) for writing the 2D marking (25) is moved in a first and in a second direction,

- a read means (17) is provided or arranged at a defined read position R along the transport path after the laser system (15) in the transport direction (21), for detecting the marking previously written by the laser system (15), said read means (17) being in connection with the control unit (47), and

- in the control unit (47) there is further present a program or a program procedure which compares the stored marking pattern to the marking detected by the read means (17) and provides a control signal in dependence on the result of the comparison, at the output of the control unit.

17. A device according to claim 16, characterised in that the position detection means (51) is an encoder (51), which provides signals (impulses) to the control unit (47) or the deflection

means (35), the number of signals or impulses per time unit being dependent on the transport speed of the transport means.

18. A device according to claim 16 or 17, characterised in that the transport speed of the transport means (13) is detected by way of the position detection means.

19. A device according to one of the claims 16 to 18, characterised in that the drive ensures a uniform transport speed of the transport means.

20. A device according to one of the claims 16 to 19, characterised in that the program of the control unit (47) or the deflection means (35) on writing (engraving) tracks the laser beam (23) in dependence on the transport speed of the transport means (13), in the transport direction (21).

21. A device according to one of the claims 16 to 20, characterised in that in the beam path of the laser light beam (23) there are provided focussing means, e.g. a convergent lens, a concave mirror or likewise, which focus the laser light beam (23) in a write plane.

22. A device according to claim 21, characterised in that the focussing means, e.g. convergent lens has a focal width f of more than 5 cm, preferably more than 10 cm, and very particularly preferred more than 15 cm.

23. A device according to one of the claims 16 to 22, characterised in that the laser system (15) uses an excimer or Nd YAG laser with frequency multiplication means (33), in particular means for frequency quadrupling.

24. A device according to claim 23, characterised in that the read means comprises a CCD camera (17).

25. A device according to claim 23 or 24, characterised in that at the read position R of the transport path there is provided at least one light source (41) which is arranged such that in operation only a part of the inscribed glass receptacle (19), but not the code marking (25), is directly irradiated.

26. A device according to one of the claims 23 to 25, characterised in that at a short distance to the light source (41) there is provided at least one opaque shielding (45) which is designed such that a direct incidence of light onto the read means (17) and the code marking (25) is prevented.

27. A device according to one of the claims 23 to 26, characterised in that are provided two light sources (41) lying opposite one another and arranged on oppositely lying sides of the transport path, which are so arranged and in each surrounded by a shielding such that only a part of the glass receptacle (19), but not the marking (25) written into the glass, is directly irradiated by the light sources.

28. A device according to one of the claims 23 to 27, characterised in that the read means (17) is arranged at a distance and essentially preferably perpendicularly or at an angle to the plane defined by the two-dimensional marking.

29. A device (11) for depositing a wipe-proof and rub-proof marking (25) or code marking, in particular a two-dimensional point or line coding consisting of a plurality of data points or pixels, onto glass or glass receptacles (19) such as glass ampoules, glass bottles, vials and likewise, with

- a transport means (13) having a drive, and with one or more accommodating means for the objects to be inscribed,

- a laser system (15) arranged at a distance to the transport means (13), with a laser source for producing a laser light beam (23) of a wavelength < 380 nm, said laser light beam in operation being directed onto the transport path and defining an impingement point in the region of at least one accommodating means moved along the transport path,

- means (35) in order to change the impingement point of the laser light beam with respect to at least one accommodation means of the transport means, e.g. by way of at least one deflection means, e.g. scanner mirror, in order to deflect the laser light beam (23) in a first and in a second direction continuously or at certain incremental intervals,

- a control unit (47) comprising a memory unit and a microprocessor, which is in connection with the laser system and the deflection means, for controlling at least the deflection system and the laser system,

characterised in that

- a means (47) is provided for detecting at least the position and preferably the speed of the transport means (13), said means being in connection with the control unit or the means (35) for deflecting the laser beam (23),

- in the memory unit there is stored a program which on operation triggers the laser in dependence on the position of the glass receptacle (19) to be inscribed, as well as at least one marking pattern (25), according to which the deflection means (35) for writing the 2D marking is moved in a first and a second direction, and

- there is provided a program or logic circuit which tracks the laser beam (23) according to the transport speed of the objects (19) to be inscribed.

30. A device according to claim 29, characterised in that a read means (17) is provided or arranged at a defined read position R along the transport path and after the laser system (15) in the transport direction (21), for detecting the marking (25) previously written by the laser system (15), said read means (17) being in connection with the control unit (47).

31. A device according to claim 29 or 30, characterised in that in the control unit (47) there is further present a program or a program procedure which compares the stored marking pattern to the marking detected by the read means (17) and provides a control signal in dependence on the result of the comparison at the output of the control unit.

32. A device according to one of the claims 28 to 30 and 16 to 27.

33. A device for depositing a wipe-proof and rub-proof marking or code marking, in particular a two-dimensional point or line coding onto glass receptacles such as glass ampoules, glass bottles, vials and likewise, with

- a transport means (13) having a drive, with one or more accommodating devices for objects to be inscribed,

- a laser system (15) arranged at a distance to the transport means with a laser source for producing a laser light beam (23) of a wavelength $< 380 \text{ nm}$, said laser light beam (23) in operation being directed onto the transport path and defining an impingement point in the region of at least one accommodating means moved along the transport path,

- means in order to change the impingement point of the laser light beam (23) with respect to at least one accommodation means of the transport means, e.g. by way of at least one deflection means, e.g. scanner mirror, in order to deflect the laser light beam in a first and in a second direction continuously or in certain incremental intervals.

- focussing means in order to focus the laser beam (23) onto the writing surface or write plane,

- a control unit (47) comprising a memory unit and a microprocessor, which is in connection with the laser system (15) and the deflection means, (35) for controlling at least the deflection system and the laser system,

characterised in that

by way of the focussing means one may produce a focus depth of more than 0.2 mm, preferably more than 0.5mm, and very particularly preferred more than 1 mm.

34. A device according to 33, characterised in that the energy density of the laser beam (23) in the region of the focus depth is $> 2 \text{ J/cm}^2$, preferably $> 5 \text{ J/cm}^2$ and very particularly preferred $> 10 \text{ J/cm}^2$.

35. A device according to one of the claim 33 or 34 and to one of the claims 16 to 28.